



INOV.LINEA

**A FoodFabLab for Industry
An Industry for Knowledge**

● INOVAÇÃO ● CONHECIMENTO ● EMPREENDEDORISMO



**TAGUS
VALLEY**

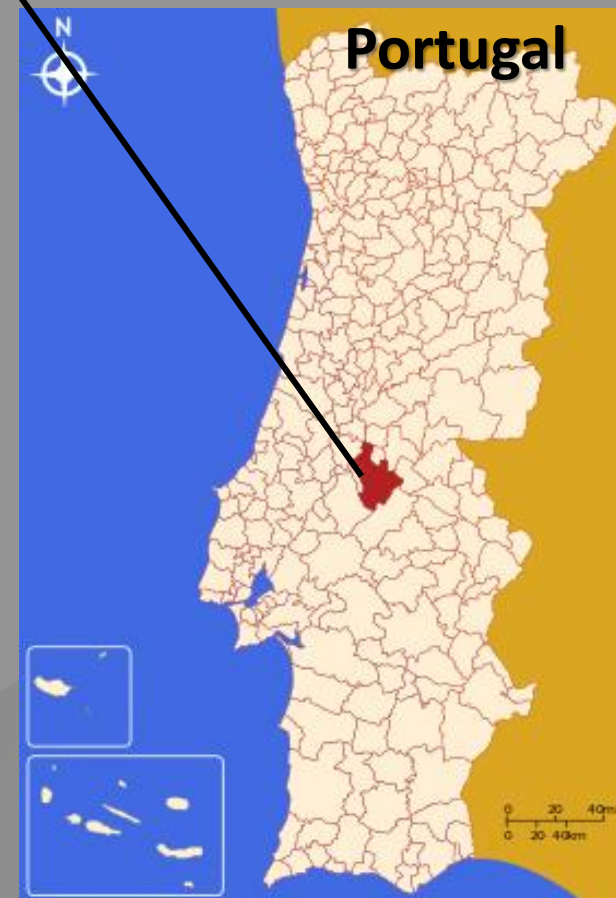
PARQUE TECNOLÓGICO
DO VALE DO TEJO



**TAGUS
VALLEY**

INOVLÍNEA
TECNOLOGÍAS ALIMENTARES

Abrantes



TAGUSVALLEY

SCIENCE AND TECHNOLOGY PARK



INOV.POINT

BUSINESS WELCOME AND ENTREPRENEURSHIP
PROMOTION



INOV.LINEA

PRODUCTION AND TRANSFER OF AGRI-FOOD
KNOWLEDGE



LINE.IPT

PRODUCTION AND KNOWLEDGE TRANSFER IN
INDUSTRIAL TECHNOLOGIES AND PROCESSES



INOV.CODE

PROMOTION OF SCIENTIFIC AND
TECHNOLOGICAL SKILLS

Networks and Partnerships

REGIONAL



NATIONAL



INTERNATIONAL





INOV.LINEA

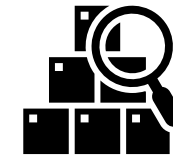
PRODUCTION AND TRANSFER OF
AGRI-FOOD KNOWLEDGE

WORKING AREAS

FOOD | CIRCULAR ECONOMY | BIOECONOMY



SERVICES



APPLIED RESEARCH

PILOT SCALE and INDUSTRIAL SCALE-UP (TRL's 5 - 9)

Innovative or emerging preservation and process technologies

Technical Team



Our team contains highly skilled human resources with multidisciplinary competencies in the areas of new product development and scale-up, processing and preservation with emerging technologies, food safety, legislative standards, and industrial equipment operation.

Currently composed of 6 members: 1 PhD and 5 MSc.

Support and Partnerships



SCIENTIFIC PARTNERS



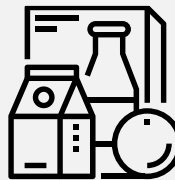
INIAV | BLC3 | CATAA | CEBAL | IP Leiria | IP Bragança | CeCoLab | CoLab for Sustainability | Universidade de Coimbra



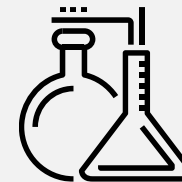
OUR SERVICES



NEW PRODUCTS OFFICE



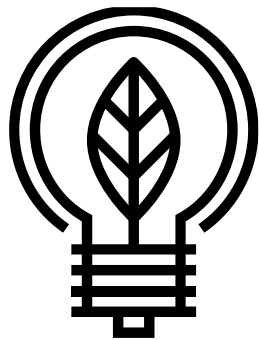
**MARKET INTRODUCTION
SUPPORT OFFICE**



FOOD FAB LAB

Our Services

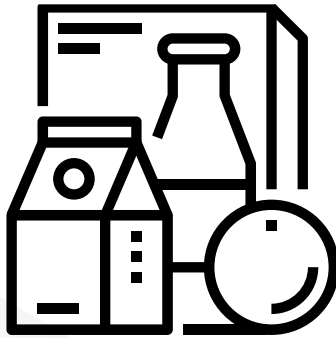
New Products Office



- Develop new products: from conceptualization to industrial production.
- Identify and validate ideas and market trends.
- Test preservation and process technologies, from the most conventional to the most innovative.
- Elevate the idea to pilot scale or industrial scale-up (TRL's 5 to 9).

Our Services

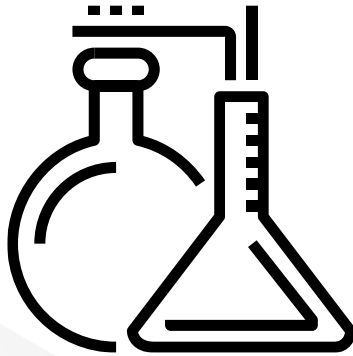
Market Introduction Support Office



- Prepare technical data.
- Create analytical plans based on legal or customer requirements.
- Test products with consumer panels.
- Determine the shelf life of the products.
- Support in the labeling and legal framework of products.

Our Services

Food Fab Lab



- Industrial space with necessary facilities in place.
- Kitchen, industrial plant, and equipment.
- Support and preparation of the industrial activity licensing process .
- Consultancy on the main requirements for conducting industrial activity.
- Test the idea on a pilot scale or carry out industrial scale-up (TRL's 5 to 9).

APPLIED RESEARCH

Research lines



**Processing and
preservation
with emerging
technologies**

**Assisted extraction
and application of
bioactive compounds**

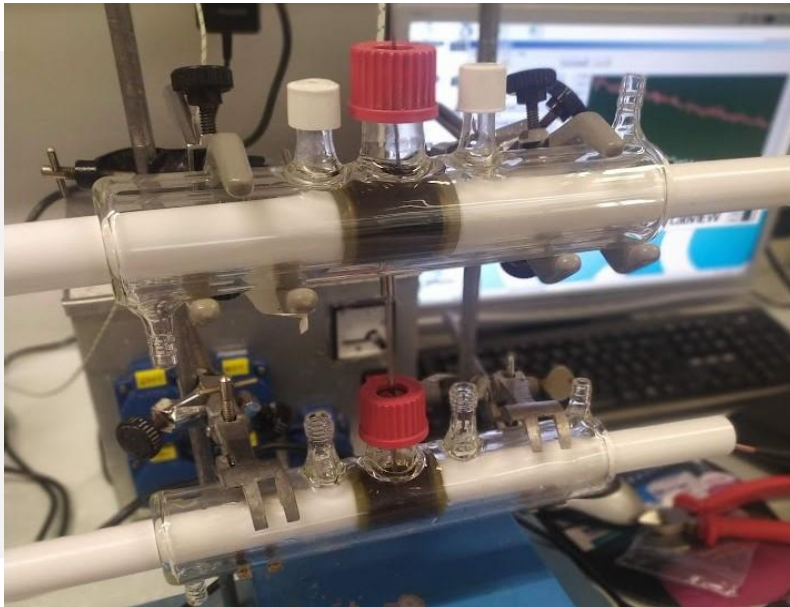
**Assisted drying
processes**

**Plant-based
products**

**Valorization of
endogenous raw
materials**

Applied Research

Processing Technologies



300 W, 50 ml, Batch Ohmic Heating Units
(University of Minho, Braga, Portugal)



30 kW, 350 L/h Continuous Ohmic Heater – Aseptic Processing
(Inovlinea, Tagusvalley, Abrantes, Portugal)

Applied Research

Processing Technologies



6 kg, Freeze Dryer Unit
(Inovlinea, Tagusvalley, Abrantes, Portugal)



130 kg, Freeze Dryer Unit
(Inovlinea, Tagusvalley, Abrantes, Portugal)

Applied Research

Processing Technologies



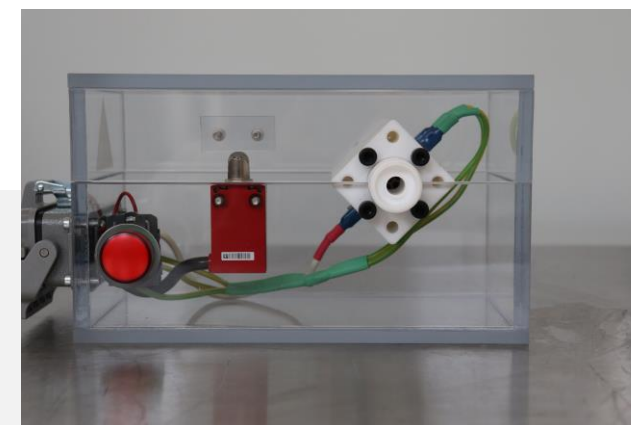
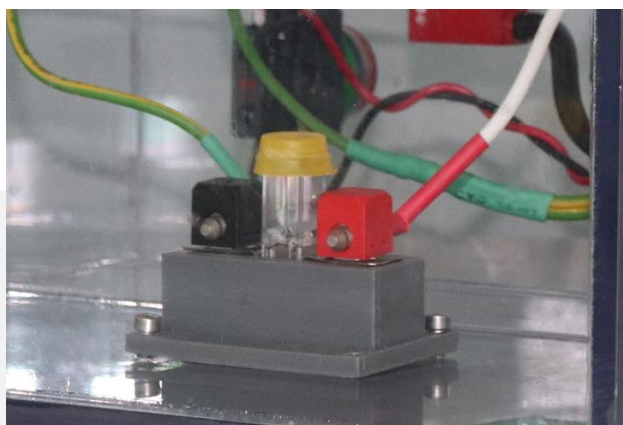
6 Lts, High Pressure Processing Unit
(Inovlinea, Tagusvalley, Abrantes, Portugal)



55 Lts, High Pressure Processing Unit
(Univerty of Aveiro, Aveiro, Portugal)

Applied Research

Processing Technologies



Applied Research

Processing Technologies



0.15 m^2 , UV-C Unit for Solid Products
(Inovlinea, Tagusvalley, Abrantes, Portugal)



Continuous UV-C Unit for Liquid Products
(Inovlinea, Tagusvalley, Abrantes, Portugal)

Applied Research

Processing Technologies



1500 W, 20 kHz, 1 – 10 L, Batch and Continuous Ultrasonics Units
(Inovlinea, Tag.usvalley, Abrantes, Portugal)

Applied Research

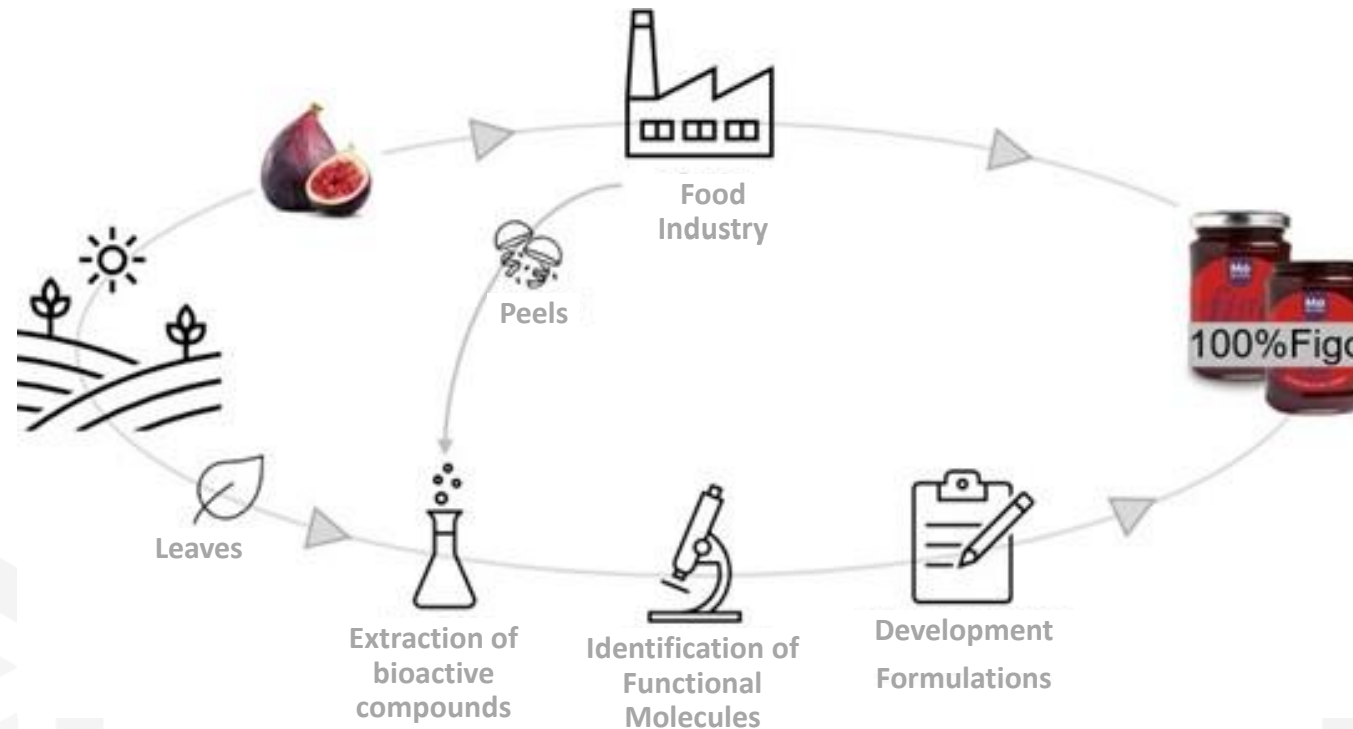
RECENT PROJECTS



- 100% Figo
- TagusValley 2030 RHAQ
- WinBio - Waste & Interior & Bioeconomy
- INOV C+
- VIIAFOOD

Applied Research

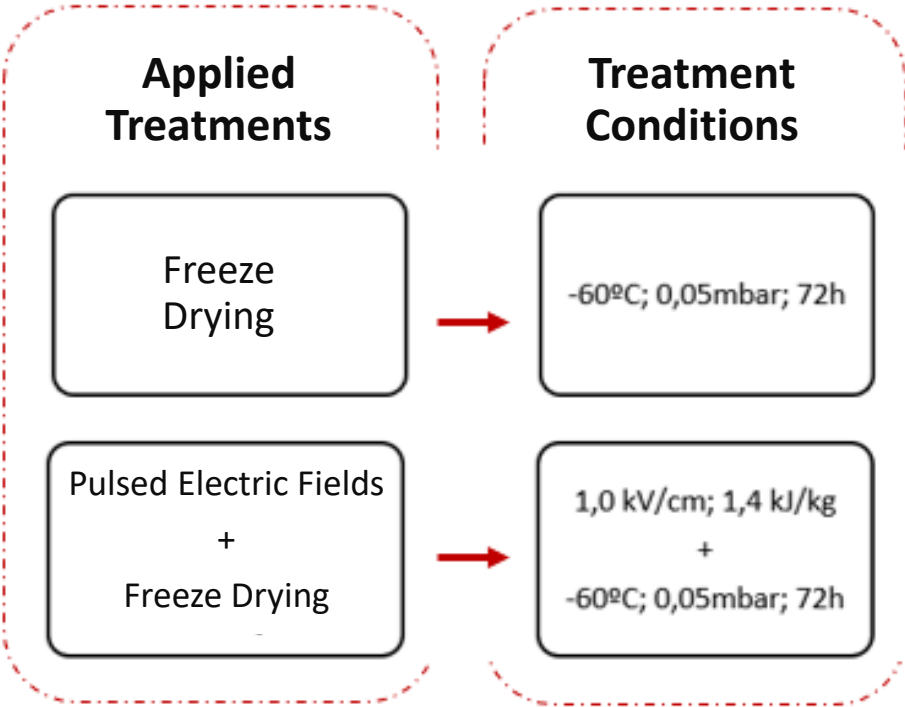
PROJECT “100% FIGO”



Applied Research

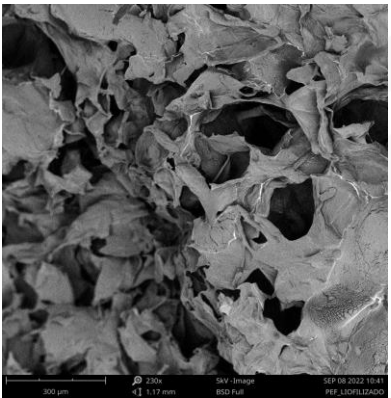
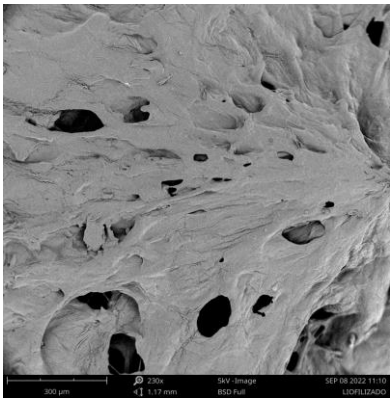
PROJECT “TAGUSVALLEY 2030 RHAQ”

COMBINED DEHYDRATION PROCESSES



Freeze
Drying

PEF + Freeze
Drying



Freeze
Drying

PEF + Freeze
Drying

Applied Research

PROJECT “WINBIO – Waste & Interior & Bioeconomy”



- Development of multiple demonstrators focusing on the valorization of raw materials and byproducts
- Utilization of innovative and emerging technologies and processes



Applied Research

PROJECT “INOVC+ Ignition Projects and Proofs of Concept”



Universidade do Minho

- Dynamization of emerging technologies (HPP, Ohmic Heating)
- Valorization of regional products (grass pea, chickpea)
- Development of new high-value-added products
- Improvement of the quality of existing products

Applied Research

PROJECT “INOVC+ Synergistic best practices”



Investigation of the impact of PEF (Pulsed Electric Field) technology on the extraction of **Galega** olive oil, a typical Portuguese cultivar, by applying a **reduced malaxation time**, with a focus on extraction yield, physicochemical characteristics, and sensory properties.



Applied Research

PROJECT VIIAFOOD - Platform for Valorization, Industrialization and Agrifood Innovation

WP10 | PROJECT A10.2. NOVEL PROCESSING TECHNOLOGIES
TO ADDRESS NEW FOOD TRENDS AND SCALE-UP CHALLENGES

Business Partners:



Scientific partners:



Applied Research

PROJECT VIIAFOOD - Platform for Valorization, Industrialization and Agrifood Innovation

WP10 | PROJECT A10.2. NOVEL PROCESSING TECHNOLOGIES
TO ADDRESS NEW FOOD TRENDS AND SCALE-UP CHALLENGES



**VIIA
FOOD**

Scientific Research



European Food Research and Technology
<https://doi.org/10.1007/s00217-022-04179-5>

ORIGINAL PAPER

New food, new technology: innovative spreadable cream with strawberry syrup

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Article

Effects of Equivalent Processing Conditions for Microbial Inactivation by Innovative Nonthermal Technologies on the Safety, Quality, and Shelf-Life of Reineta Parda Apple Puree

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Pulsed electric field technology as pretreatment to enhance strawberries (*Fragaria ananassa*) drying efficiency, nutritional and physicochemical quality

Patricia Antunes, Sara Dias, Diogo Gonçalves, Enrique Pino-Hernández, Telma Orvalho, Marta B. Evangelista, Marco Alves*

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Article

Structural and Physicochemical Properties of Starch from Rejected Chestnut: Hydrothermal and High-Pressure Processing Dependence

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Utilização de radiação Ultravioleta (UV-C) como tecnologia alternativa aos sulfitos para a estabilização microbiológica de vinho tinto – Resultados prévios

Employment of ultra-violet (UV-C) radiation as an alternative technology to sulfites for the microbiological stability of red wine – preliminary results

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Article

Challenges and opportunities for pilot scaling-up extraction of olive oil assisted by pulsed electric fields: process, product and economic evaluation

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Scientific Research

CONSERVAÇÃO

Liofilização: as vantagens dos pré-tratamentos emergentes

FREEZE-DRYING: THE ADVANTAGES OF EMERGING PRE-TREATMENTS



RESUMO

Alimentos perecíveis, como as frutas e vegetais, são propensos a reações bioquímicas e ao crescimento microbológico devido à elevada atividade de água que possuem. A desidratação é um método eficaz para estabilizar esses alimentos, garantindo assim a segurança alimentar e diminuindo o desperdício alimentar. Destaca-se entre os processos de desidratação, a liofilização, uma tecnologia não térmica com maior capacidade de preservar nutrientes sensíveis ao calor e manter as características organolépticas do alimento. Contudo, a implementação industrial da liofilização enfrenta desafios devido ao seu elevado tempo de processamento e ao maior consumo de energia em comparação com a desidratação convencional. Neste âmbito, a aplicação de pré-tratamentos emergentes como os campos elétricos pulsados, ultrassons e as altas pressões hidrostáticas, oferecem melhorias significativas no tempo de liofilização e nas características do alimento. A introdução destes processos inovadores pode facilitar a implementação industrial através da redução de custos e do aumento da aceitabilidade por parte do consumidor.

Palavras-chave: liofilização; PEF; altas pressões hidrostáticas; ultrassons; tecnologias emergentes.

ABSTRACT

Perishable foods such as fruit and vegetables are prone to biochemical reactions and microbiological growth due to their high water activity. Dehydration is an effective method for stabilising these foods, thus guaranteeing food safety and reducing food waste. One dehydration process that stands out is freeze-drying, a non-thermal technology with a greater capacity to preserve heat-sensitive nutrients and maintain the organoleptic characteristics of the food. However, the industrial implementation of freeze-drying faces challenges due to its high processing time and higher energy consumption compared to conventional dehydration. In this context, the application of emerging pre-treatments, such as pulsed electric fields, ultrasound and high hydrostatic pressures, offer significant improvements in freeze-drying time and food characteristics. The introduction of these innovative processes can facilitate industrial implementation by reducing costs and increasing consumer acceptability.

Keywords: freeze-drying; PEF; high hydrostatic pressures; ultrasound; emerging technologies.

CONTEXTUALIZAÇÃO

Os alimentos perecíveis, como os frutos e os vegetais, possuem geralmente valores elevados de atividade de água (a_w), o que favorece as reações bioquímicas e o crescimento microbológico. Estes efeitos podem provocar alterações organolépticas indesejáveis no produto e por em causa

a segurança alimentar, inviabilizando o seu consumo (Fissore e Velardi, 2012; Orphanides *et al.*, 2016). Por esta razão, os alimentos perecíveis são os principais contribuintes do desperdício alimentar que se evidencia atualmente. Torna-se assim fundamental diminuir a suscetibilidade deste tipo de alimentos, de forma a evitar quebras de stock nas indústrias e nas residências familiares.

Um dos processos mais utilizados para a estabilização dos alimentos perecíveis é a desidratação. Este processo consiste em reduzir o teor de água do produto até que o mesmo atinja um nível seguro, podendo ser aplicada para garantir a qualidade microbiológica e físico-química do produto a ser armazenado durante um determinado período de tempo (Santos *et al.*, 2019). O processo de desidratação atribui propriedades atraentes comparativamente a outra tecnologia de conservação uma vez que, apresenta uma excelente estabilidade à temperatura ambiente, ampla versatilidade de processo e produto e um impacto considerável na diferenciação do produto.

«A velocidade de amarelecimento é crucial no desenvolvimento dos cristais, velocidades mais elevadas produzem cristais de gelo mais pequenos e, consequentemente, os danos nas estruturas biológicas são menores»

Para além da estabilização do produto, é importante para o consumidor manter a qualidade organoléptica e nutricional do alimento desidratado. Neste âmbito a liofilização é tida como processo de desidratação com maior potencial de proporcionar os melhores características organolépticas e nutricionais quando comparado com outros tipo de desidratação, como por exemplo a desidratação por ar quente.

Nesta análise aborda-se o processo de liofilização assistida por pré-tratamentos

60

CAMPOS ELÉTRICOS PULSADOS

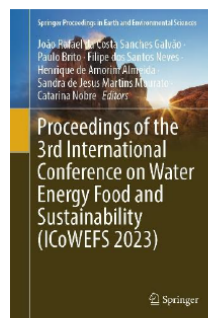
Técnica

CAMPOS ELÉTRICOS PULSADOS NA CIÊNCIA E INDÚSTRIA ALIMENTAR

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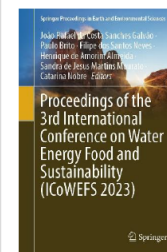
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Proceedings of the 3rd International Conference on Water Energy Food and Sustainability (ICoWEFS 2023)

Effect of High-Pressure Processing Combined with Propolis Extract on the Quality and Microbiological Safety of Apple Puree

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Apple Puree Pasteurization by Pulsed Electric Fields: From Microbial Safety to Financial Viability Assessment

Enrique Pino-Hernández¹, Paula Valério, Sara Dias, Marta B. Evangelista, and Marco Alves



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